PRINCIPES

Journal of The Palm Society

October, 1961
Vol. 5, No. 4

OCT 23 1961

THE PALM SOCIETY

A non-profit corporation primarily engaged in the study of the palm family in all its aspects throughout the world. Membership is open to all persons interested in the family. Dues are $10.00 per annum payable in May. Requests for information about membership or for general information about the Society should be addressed to the Executive Secretary.

PRESIDENT: Eugene D. Kitzke, S. C. Johnson & Son, Inc., Racine, Wisconsin.

VICE-PRESIDENT: David Barry, Jr., 11977 San Vicente Blvd., Los Angeles 49, California.

EXECUTIVE SECRETARY: Mrs. Lucita H. Wait, 7229 S.W. 54th Ave., Miami 43, Florida.

TREASURER: Walter J. Murray, 13935 Cartee Road, Miami 56, Florida.

DIRECTORS: Paul H. Allen, Honduras; David Barry, Jr., California; Duncan Clement, Cuba; Nat J. De Leon, Florida; Mrs. David Fairchild, Florida; William Hertrich, California; Walter H. Hodge, Pennsylvania; Mrs. Alvin R. Jennings, New Jersey; Eugene D. Kitzke, Wisconsin; Mrs. A. C. Langlois, Bahamas; Harold F. Loomis, Florida; Frank R. May, Florida; Harold E. Moore, Jr., New York; Nixon Smiley, Florida; Dent Smith, Florida.

PRINCIPES

JOURNAL OF THE PALM SOCIETY

An illustrated quarterly devoted to information about palms published in January, April, July, and October, and sent free to members of The Palm Society

EDITOR: Harold E. Moore, Jr.

EDITORIAL BOARD:

Paul H. Allen, David Barry, Jr., Duncan Clement, Walter H. Hodge, Eugene D. Kitzke, Harold F. Loomis, Nixon Smiley, Dent Smith.

Manuscript for PRINCIPES, including legends for figures and photographs, must be typed double-spaced on one side of 8½ x 11 bond paper and addressed to the Editor at Bailey Hortorium, Mann Library, Cornell University, Ithaca, New York, for receipt not later than 45 days before date of publication. Authors of one page or more of print will receive six copies of the issue in which their article appears. Additional copies or reprints can be furnished only at cost and by advance arrangement.

Contents for October

Johannesteijsmannia—A New Name for the Palm Genus Teysmannia
Harold E. Moore, Jr. 116

Essays on the Morphology of Palms
VI. The Palm Stem
P. B. Tomlinson 117

Nature's Biggest Bouquet
W. H. Hodge 125

Palms of Colombia
Armando Dugand 135

Index 144

Regular Features
News of the Society 115

The Editor's Corner 134

Cover Picture

Massive leaf bases (petioles) radiate out with impressive phyllotaxy from the trunk of a talipot palm. Photograph by W. H. Hodge.

Mailed at Miami, Florida, 1 October 1961

NEWS OF THE SOCIETY

You will be gratified to learn, I feel sure, that the response to the President's and Treasurer's letters informing members about the change in fiscal policies has been highly favorable. To date, 387 members have adjusted their dues to fit the new May 1st deadline, and many of them have increased their donations. A number of members took the trouble to add a note expressing their approval of the new arrangement and wishing the Society continued growth and success. There have been a few resignations, and one or two have stated that they do not approve of the change. The large majority, however, have been most cooperative, and are hereby tendered the thanks of the Society's officers and directors, and of the finance committee.

* * *

The summer doldrums have descended, and there is little to report in the way of activities. On July 16th the California group held another successful tour of the Santa Barbara area, with its many fascinating palms. Gathering first at Deigaard's Nursery, Goleta, they were met by member Otto Martens, who showed them over the thirty-three acres where hardy palms are grown out of doors and the more tender howeias, raised from seeds imported from the famed Lord Howe Island, are grown under lath. Mr. Martens delighted members with a gift to each of a seedling of Santa Barbara's most celebrated palm, *Rhopalostylis sapida*, the Nikau palm of New Zealand.

From Deigaard's the group went on to view the charming garden of Mr. Decker, which is situated on a promontory overlooking the Pacific. The mild environment permits landscaping with palms and tropical material, handsomely carried out, as well as cacti and other succulents. At Oak Park, where a picnic lunch was enjoyed, the group was joined by Santa Barbara's arborist, Mr. William Beitel, and seedsman Eugene Baciu. These experts guided them on a tour of the County Court House grounds and Alameda Plaza, both of which have many fine specimens of mature palms.

The climax of the visit was a trip to El Mirador Estate in Montecito, to revisit what is possibly the finest stand of *Rhopalostylis sapida* and *R. Baueri*, (interspersed with many fine howeias and archontophoenix), in the western hemisphere. Mr. Baciu presented members with seedlings of *R. Baueri*.

The Californians wish to express their sincere thanks to Mr. Martens, who planned the visit in every detail, with such successful results.

* * *

Word has been received of the tragedy at Borrego Springs, California, where fire destroyed at least 118 Washingtonias in Anza-Borrego Desert State Park's palm canyon. It was believed that a discarded cigarette may have caused the fire, which also damaged 103 other palms, and blackened twenty acres of brush. These palms were "the main attraction" at the park's camp site, and were over 30 years old (probably much more). It is sincerely to be hoped that not all of the "destroyed" trees are irreparably harmed.

* * *

Dr. Walter Hodge's article on the Linospadix palm of Australia came at a very opportune time, as a large number of members are now trying to germinate seeds of this attractive small palm. An ardent planter of palm seeds, Nat De Leon, told the writer that he gave up too soon and dumped two lots of seeds before he found out that germination is very slow. On the third attempt he succeeded, through sheer patience, in obtaining seedlings.

From Mr. Richard B. Murrow, Los Angeles, Calif.: "A suggestion—PRINCIPES would be even more useful to hobbyists like myself if it contained more advertisements of growers and seedsmen offering seeds and seedlings of unusual palms. And such advertising might be an excellent source of additional revenue to help support PRINCIPES and the Society." So come ahead, you growers of the unusual, let's know who and where you are and what you have.

Lucita H. Wait

Johannesteijsmannia—A New Name for the Palm Genus Teysmannia

HAROLD E. MOORE, JR.

The palm genus *Teysmannia*, with a single species *T. altifrons* native in Sumatra, the Malaya Peninsula and Borneo, has been known for over a century. It was discovered by Johannes Elias Teijsmann* (1808-1882), a Dutch gardener and botanist at the botanical gardens in Buitenzorg, Java (now Bogor, Indonesia), during an expedition to the west coast of Sumatra in 1856-1857 and was described in the twenty-eighth volume of a botanical periodical, *Linnaea*, for which the title-page date is 1856. The same name was given independently to a genus of the family Apocynaceae in 1857 (*Teysmannia* F. A. W. Miquel in *Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen* (Amsterdam) 6: 193. 1857).

Despite the title-page date of 1856, the volume of *Linnaea* concerned was published in parts. That in which *Teysmannia* appeared is dated February 1858. The same name cannot be used for more than one kind of plant by international agreement of botanists, and when a duplication has occurred in the past, the name first published in proper form has priority over any later name even though the first be no longer in use. Thus the name *Teysmannia* cannot be used for the palm genus.

A search for a substitute name has revealed none. It is now necessary either to propose conservation of the name *Teysmannia* for a genus of a single species not of especial economic or other importance, an inappropriate course of action, or to provide a new name. The name *Johannesteijsmannia* has been coined as one which preserves the rightful tribute to Teysmann and yet does not conflict with the very similar *Tessmanniodoxa*, *Tessmanniophoenix* or *Neotessmannia* applied to other genera (the first two palms) and honoring Günther Tessmann, a German ethnologist. Regrettable as it may be, the palm heretofore known as *Teysmannia altifrons* should now be known as *Johannesteijsmannia altifrons*.

Johannesteijsmannia H. E. Moore, **nom. nov.**

Teysmannia H. G. Reichenbach et Zollinger in Zollinger, *Linnaea* 28: 657. Feb. 1858 ('1856') ('*Teyssmania*'); corr. F. A. W. Miquel, *Flora Indiae Batavae* 3: 749. 1859 not *Teysmannia* F. A. W. Miquel (1857).

Johannesteijsmannia altifrons (H. G. Reichenbach et Zollinger in Zollinger) H. E. Moore, **comb. nov.**

Teysmannia altifrons H. G. Reichenbach et Zollinger in Zollinger, *Linnaea* 28: 657. Feb. 1858 ('1856').

*The spelling Teysmann is an alternate form. In providing a new name I am reverting to the Dutch spelling as orthographically correct.

Essays On The Morphology Of Palms

P. B. Tomlinson

VI. THE PALM STEM

In woody dicotyledons, represented by our hardwood trees, increase in thickness of the stem is a result of cell division in a cylinder of actively dividing or meristematic cells, the cambium, situated between the hard wood, or xylem, of the stem and the softer part of the bark, or phloem. This cambium originates early in young seedlings and is continually developed in all new shoots. Since it also remains active throughout the life of the plant, the slender sapling is able to develop into a tree with a wide massive bole. Consequently, although the crown of the tree continually increases in size through branching, it is always supported effectively by an ever-widening trunk (Fig. 58A-C). Monocotyledons, on the other hand, with few exceptions have no cambium and so are not capable of gradual development into trees. Palms, however, are rather exceptionable amongst monocotyledons in that woody trunks, often over 100 feet high are typically developed. Even so, palms have no permanently active thickening meristem. How then, does the palm develop its erect solid trunk? Before this question can be answered, we must understand the construction of the mature palm stem. A brief outline of the anatomy of the palm stem will therefore serve as an introduction to the mechanism of its growth.

The Anatomy of the Palm Stem

Botanists have been interested in the internal structure of palm stems for many years and although a generalized picture of their construction is now available, a surprising amount of fundamental detail is still obscure. The reason for this dearth of information is largely technological and not difficult to understand. The palm stem is a massive organ, not homogeneous, and, to the anatomist, very complex. The mature parts are often hard and brittle, so that it is difficult to cut sections of them thin enough to be studied under the microscope. One small area of the palm stem does not give a true picture of the whole. The wood of a dicotyledonous tree is, on the other hand, usually easy to section and is comparatively homogeneous so that a good knowledge of the anatomy of the whole stem can be gained by studying a small block of wood. One other great difficulty is that no botanist working in a temperate climate has access to unlimited palm material. Palms only appear in abundance in the tropics and even in regions to which palms are native the anatomist can rarely collect freely because his methods are essentially destructive and palms are large and valuable plants.

It is therefore not surprising to learn that most of our information about the anatomy of the palm stem is based on observations made over 100 years ago. Although various peculiarities of the palm stem, more particularly the ways in which it differs from the woody trunk of a dicotyledon, had been established by the earliest botanists and were even known to Greek writers of classical times, the most fundamental studies were made by Hugo von Mohl. His account was first published, in Latin, in Martius's monumental work *Historia Naturalis Palmarum* (1831). It is characteristic of the quality of this work that the anatomical illustrations it contains have never been bettered. Translations of this

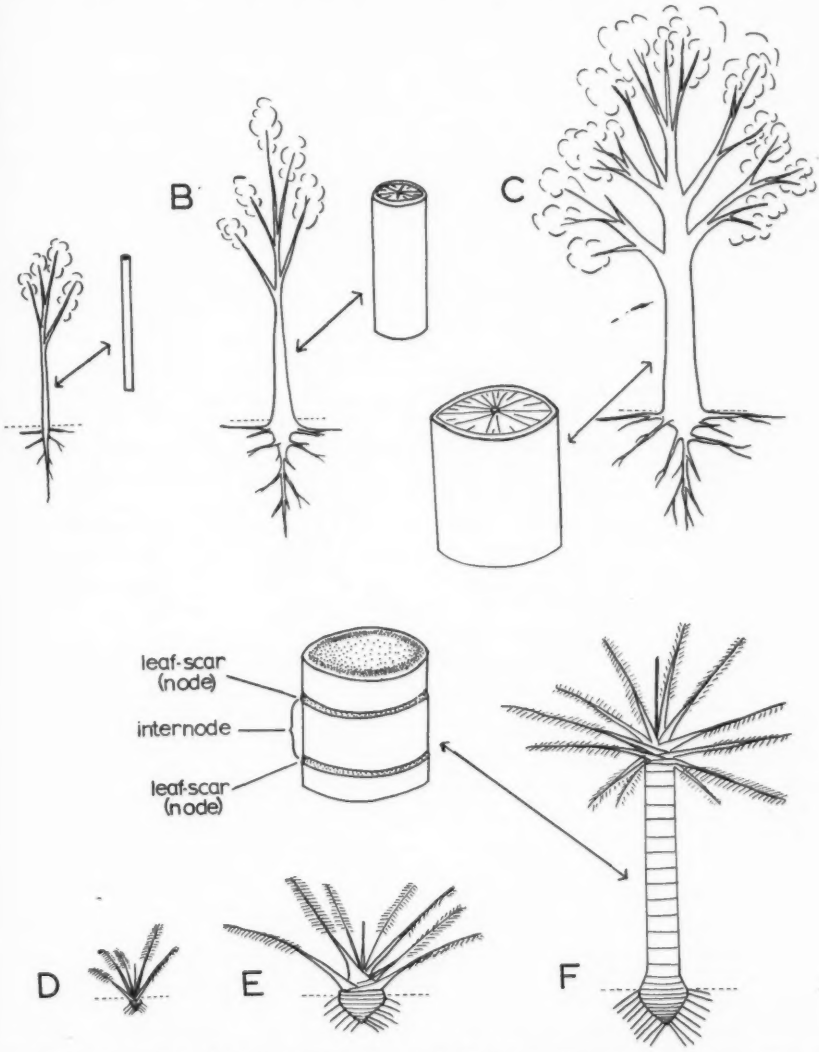
account exist in German and English, but without the illustrations.

A typical palm stem (Fig. 59A), exemplified by that of the coconut (*Cocos nucifera*), unlike the homogeneous woody cylinder of a hardwood tree (Fig. 59B), contains a system of many hundreds of separate conducting strands, or vascular bundles scattered in softer ground tissue. Each vascular bundle consists of a rigid fibrous sheath, wholly or partly enclosing the conducting tissues proper. These tissues consist of a strand of phloem elements, which conduct organic food material, and xylem elements, which largely conduct water against gravity. The fibrous part of the bundle is always most conspicuous adjacent to the phloem, it is commonly absent adjacent to the xylem. The bundles towards the periphery of the stem are very congested and since they possess very well developed fibrous sheaths they together form a much denser tissue than the softer central portions. In fact, most palm stems have such a soft central region that they split and collapse on drying and so have little use as constructional timber. In the living palm, however, such a distribution of supporting tissues permits the maximum amount of strength and stability with the most economic use of strengthening tissue. In fact the palm is constructed according to the best principles of engineering.

The palm stem, as seen in transverse section, is divided into two very unequal regions (Fig. 59B). The central region, described above, is known as the central cylinder. This is surrounded by a very narrow cortex which includes only a few narrow vascular bundles and frequent strands composed wholly of fibres. Sometimes the ground tissue of the central cylinder also includes scattered narrow fibrous strands.

In a longitudinally split palm stem it can be seen that individual vascular bundles are very long, but their length is not indefinite. Nor are the bundles distributed entirely at random as seems possible from a superficial examination of a transversely cut face. Von Mohl was able to dissect out some of the individual bundles from partially rotted pieces of palm stem. He found that each vascular strand eventually extends into a leaf. Such vascular bundles are known as leaf traces and all vascular bundles in a palm stem appear to be leaf traces. In an old palm stem, of course, only the more distal bundles extend into an attached leaf. The leaves with which lower traces are connected have fallen so that the lower vascular bundles terminate blindly at a leaf scar. There are, however, frequent fusions between bundles in various parts of the stem which maintain vascular continuity between the leafy crown and the base of the stem. If a single leaf trace is followed downwards from a leaf into the stem (Fig. 60B), it passes through the dense peripheral tissue into the centre of the stem at a fairly sharp angle. On reaching the centre of the stem, the trace turns downwards. Its subsequent course is not exactly vertical because, as it passes through many internodes on its downwards course, it gradually re-approaches the periphery of the stem and re-enters the region of congested bundles. Here it may either end blindly or, more often, it fuses with adjacent vascular bundles. In palms with very short internodes in which the leaves are crowded together on the stem, recently entered leaf traces are very conspicuous because they enter the stem almost horizontally. Even in palms with long internodes, recently entered traces can usually be recognized in the polished longitudinal face of a sawn palm stem since they run at a distinct angle to the remaining, more or less

vertical bundles. The congestion of the vascular bundles at the periphery of the central cylinder is thus seen to be a result of the overall course of each bundle, each bundle passing in and out of the central region over a short dis-



58. The palm and the hardwood tree compared. A, B, and C. Diagrammatic representation of a dicotyledonous tree at three successive ages. The insets are representations of lengths of the main trunk at the same height, from individuals of the three different ages. D, E, F. Diagrammatic representation of a single-stemmed palm at three successive ages. Inset a length of the aerial trunk, only developed at the oldest stage.

tance, but remaining in the peripheral region for a greater distance. However, the arrangement is probably much more complex than the simple scheme outlined above. Each leaf contributes many hundreds of traces to the stem and all bundles do not behave alike. There is a tendency for them to corkscrew irregularly and there may be fusion between different bundles in any part of their course, as well as at their lowest extremities. Most differences are found between leaf traces from median and lateral parts of a single leaf.

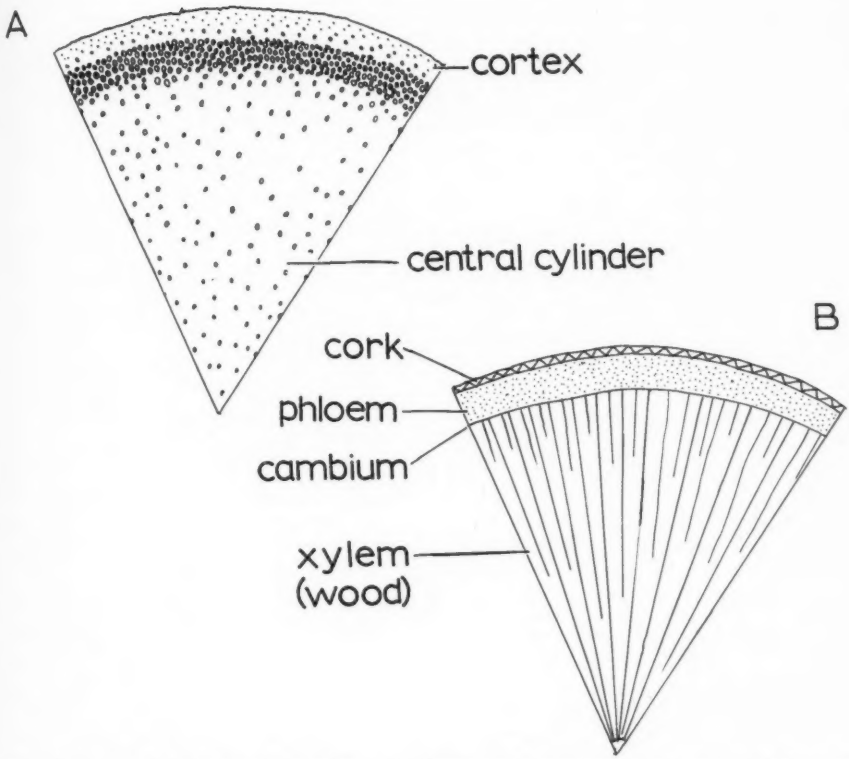
The structure of a single trace is not the same at all levels. Consequently, microscopic examination of the transversely cut face of a single palm stem reveals a bewildering variety in the structure of vascular bundles. This is because the cut will have passed through the distal part of some leaf traces but through the middle and basal parts of other traces. Von Mohl demonstrated that in the upper part of each trace there are many xylem elements and the fibrous sheath around the phloem is not well developed. Towards the base of the same trace both xylem and phloem are much reduced and the bundle is made up mainly of fibres and commonly ends blindly as a purely fibrous strand. However, over a large part of its middle course the bundle is fairly uniform; it commonly contains either one or two wide vessels and since this part is most commonly observed in a transverse section which includes the centre of the stem, its appearance is of some diagnostic value.

One further conspicuous difference between the palm stem and the trunk of a woody dicotyledon is that the latter develops a protective bark, arising from a specialized layer of meristematic cells, the cork cambium. Palms do not develop so specialized a protective tissue, one reason being that the surface of the trunk does not undergo continual expansion. In many instances the persistent leaf bases may afford some protection. Otherwise in many palms the surface layers of cells become thick-walled and sclerotic owing to the deposition of hard cell-wall substances known as lignin. These thick-walled cells gradually erode from exposed surfaces, but they are replaced by gradual modification of deeper-seated cells. In some palms, cell division does take place in the outer cortex, producing protective cork cells, but a specialized, single-layered cork meristem, like that of a dicotyledonous tree, can never be recognized. Aerating organs, comparable to the lenticels of dicotyledons, only arise passively as the result of irregular vertical splits, presumably as a result of slight internal expansion.

The Anatomy of Specialized Palm Stems

The above remarks apply to the aerial stems of single-stemmed or tufted palms (see Tomlinson, 1961a). Where the palm has a stem which differs markedly from this type, as in scandent or in creeping palms, the anatomy is considerably modified, although the fundamental plan of construction remains the same. Climbing palms, as exemplified by the rattans of the Eastern tropics, have narrow stems with exceedingly long internodes. The surface remains smooth and often becomes heavily silicified. The cortex is very narrow. The texture of the stem is relatively homogeneous because the vascular bundles are uniformly crowded and mechanical fibrous tissues are not strongly developed. The conducting tissues are well developed and the stem as a whole is very porous because the xylem vessels are very wide. Such stems are remarkable, more for their elasticity than their rigidity.

Palms with short, mostly subterranean or creeping stems have very congested



59. The stem of the tree and the palm. A. Diagrammatic cross-section of a sector of the stem in a palm. B. Diagrammatic cross-section of a sector of the stem in a tree.

internodes. The cortex is wide and often not well demarcated from the central cylinder, since the vascular bundles are uniformly scattered and not specially congested at the periphery of the central cylinder. The course of the vascular bundles is very irregular. Mechanical tissues are usually reduced and as a consequence, the texture of the stem is rather soft.

On the basis of these anatomical notes it should now be possible to understand as much as is known about the development of this peculiar axis.

The Growth of the Palm Stem

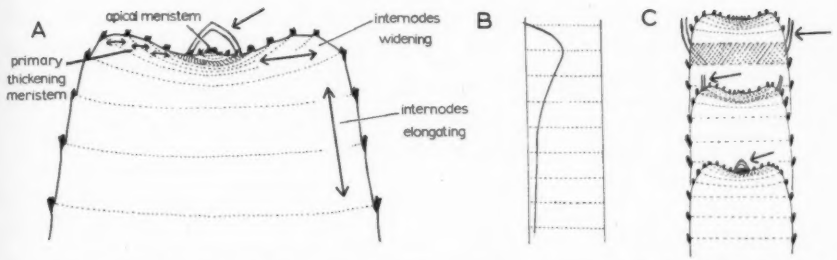
Botanists familiar with the development of the palm from the seedling stage know that its stem first grows considerably in girth and develops a broad woody foundation before the leafy crown is visibly raised above the soil surface and the aerial stem is developed (Fig. 58 D-F) (see Tomlinson, 1960). In this predominance of thickening growth over extensive growth, the palm contrasts remarkably with dicotyledons. In the dicotyledons, primary (elongation) growth always precedes secondary (thickening) growth so that tall but slender saplings are characteristic of

early stages in the life of hardwood trees (Fig. 58A). Thus we measure the age of a dicotyledonous tree by the thickness of its bole, but the age of a palm is indicated only by its height. Even then the tallest palm is not necessarily the oldest because different species grow at different rates.

The reason for the fundamental difference between a palm and a dicotyledonous tree is that the former has no permanently active cambium by which its stem thickens and can become consolidated. Consequently, all the tissues of the palm stem are developed within the terminal bud. Each internode therefore must grow to something approaching its maximum thickness before it can grow in length. One most obvious result of this failure of the internodes to elongate as soon as they appear is that the leaves are congested in a terminal crown. The peculiarities of stem development in palms can be most clearly revealed if successively younger leaves, of decreasingly smaller size, are carefully dissected away from the terminal rosette. Then it is found that the unexpanded leaves are not arranged on the sides of a long tapering cone, as in a dicotyledon, but that they are situated on the surface of a shallow, basin-like depression at the apex of the stem (Fig. 60A).

The microscopic apical meristem is situated at the centre of the depression and on this minute papilla, the leaf primordia originate. It is evident that as each leaf primordium grows in size, its circular insertion widens, but not as a result of activity of the apical meristem proper, this being solely the leaf-initiating meristem, but by the activity of a somewhat hemispherical thickening meristem which forms the "bowl." Only when the leaf bases have been carried to the rim of the basin do their associated internodes extend and bring about increase in length of the stem (Fig. 60C). Because this bowl-shaped meristem functions in widening the internodes before they are elongated, it is called a primary thickening meristem. Its behaviour has been described most recently by Helm (1936) and Ball (1941). This part of the palm, together with the younger leaves is often edible and highly nutritious. It is protected by the woody leaf bases of the outermost leaves at the crown and often also by additional spines of various kinds. This is necessary because the palm bud is attractive to some of the larger forest mammals as the owner of a large oil palm plantation is likely to discover.

Only one attempt has been made to relate the developmental changes taking place at the apex of the palm stem with the structural arrangements seen in the mature stem. This was done by an American geologist, J. C. Branner (1883) as a result of observations on many Brazilian palms studied at first hand. Unfortunately his analyses were never published in detail and, although his conclusions seem very reasonable, they have never found their way into botanical textbooks. Branner showed, with considerable conviction, that the course of each vascular bundle in the stem was the result of the peculiar configuration of tissues at the apex of the stem. Since we have already seen that the distribution of vascular bundles in the stem accounts for its overall construction, Branner offered an explanation of the peculiarities of the palm stem based on simple mechanical laws. It is not possible to interpret this complex analysis in this present brief article, although I have attempted to do this elsewhere in summarizing the whole of our knowledge of the palm stem (Tomlinson, 1961b). However, anybody wishing to



60. Development of the palm stem. A. Diagrammatic vertical section of the bud of a palm. B. Course of a single leaf trace in the stem represented diagrammatically. C. Increase in height of the palm stem, represented by a diagrammatic vertical section of the bud at 3 successive ages. (Nodes are represented by dotted lines. Only the insertions of leaf bases are shown, in solid black.)

In A and C a single leaf is shown (see single-headed arrow), its outline not blacked out. The development of its associated internode, which is cross-hatched, is represented by the three successive drawings of C. Diagram A may be regarded as an enlargement of the lowest bud of C.

understand the nature of the palm stem should be familiar with Branner's ideas.

Secondary Thickening in the Palm Stem

The above account indicates that the tissues of the palm stem originate entirely in primary meristems and that no permanent, long-lived secondary meristem exists which can add tissues to the mature stem, as does the cambium in all woody dicotyledons. Nevertheless, close examination of growing palms suggests that secondary thickening of their stems does occur. This is most obvious in *Roystonea* in which the trunk tapers considerably from below upwards in young plants, but is uniformly cylindrical in the tall stems of old plants. Careful measurements by a number of workers during the last century and subsequently has confirmed this superficial observation and shown that over a period of years the stem in many palms, as well as in *Roystonea*, does increase appreciably in girth. The most extensive observations are those of Schoute (1912) who, in addition to summarizing early observations, was able to work on the large living collection of palms in the botanic gardens at Bogor (then Buitenzorg). Although none of the palms he examined had a secondary meristem, secondary growth in girth could be measured in many of them. This was a result largely of expansion and division of the ground tissue cells, togéther with expansion of the fibres which form the vascular bundle sheaths. Because this expansion is not restricted to any one region of the palm stem, it can be called diffuse secondary growth. In most palms this secondary expansion is restricted to the terminal region of the stem, still enclosed by leaf bases. In other palms, of which *Roystonea* is perhaps the extreme example, expansion of the ground tissue continues well below the leafy crown and it may be detected even at the base of quite old palms. The most noticeable result of this process is that the ground tissue cells become lobed or stellate and wide intercellular spaces are produced. As a result the central tissues are very soft and spongy. To accommodate the expansion of the central regions, tangential expansion of the cortical cells is very marked. In the same way development of superficial protective tissues may be stimulated by expansion of the surface.

Ventricose Palm Stems

Palm stems frequently bear distinct ventricose swellings. These are most conspicuous in the so-called "belly" or "bottle" palms which include species of *Acrocomia*, *Colpothrinax* and *Iriartea*, in which the swelling may have a diameter as much as two to three times that of the non-swollen stem. The tallest individuals of the West African *Borassus aethiopum* are very distinctive because they may bear two or even three successive dilations. No adequate explanation for the origin of these swellings has been made, although it has been suggested that they are regions in which food and water reserves may be stored. From my own observations on *Borassus* in West Africa, it seems that they are not localized areas of diffuse secondary growth but rather that the whole stem apex is enlarged during their production. This suggests that they result from enhanced vegetative vigour of the primary thickening meristem.

The reverse of this situation is known to occur. Harshberger (1905) has recorded in *Sabal* that reduction of vegetative vigour in unfavourable seasons causes localized constrictions of the aerial stem, a phenomenon which produces "hour-glass" stems. That decrease in overall stem diameter is the result of the onset of reproductive activity is known for *Pseudophoenix vinifera*, in which the stem has the shape of an attenuated wine-bottle, the long "neck" being developed when the palm starts to flower (Read, 1961).

It is hoped that these notes on the palm stem will be understood by palm-growers and help to eliminate some of the misconception which exists over this subject. I have summarized all the available literature elsewhere (Tomlinson, 1961) and in doing so have been convinced of the need for much more detailed work. Our comprehension of the structure and development of the palm stem is still so sketchy that its study can be said scarcely to have begun.

Literature Cited

Ball, E. 1941. The Development of the Shoot Apex and of the Primary Thickening Meristem in *Phoenix canariensis* Chaub. with Comparison to *Washingtonia filifera* Wats. and *Trachycarpus excelsa* Wendl. *American Journal of Botany* 28: 820-832.

Branner, J. C. 1884. The Course and Growth of the Fibro-vascular Bundles in Palms. *Proceedings of the American Philosophical Society* 21: 459-483.

Harshberger, J. W. 1905. The Hour-glass Stems of the Bermuda Palmetto. *Proceedings of the Academy of Natural Sciences, Philadelphia*, 57: 701-704.

Helm, J. 1936. Das Erstarkungswachstum der Palmen . . . *Planta* 26: 319-364.

Mohl, H. von. 1831. "De Structura Palmarum" in von Martius, *Historia Naturalis Palmarum* 1: iii-lii

Read, R. W. 1961. A Study of the Genus *Pseudophoenix*. pp. 97. M. S. Thesis, Cornell University.

Schoute, J. C. 1912. Uber das Dickenwachstum der Palmen. *Annales du Jardin Botanique de Buitenzorg*, ser. 2, 11: 1-209.

Tomlinson, P. B. 1960. Essays on the Morphology of Palms. II. The Early Growth of the Palm. *Principes* 4: 140-143.

———.1961a. V. The Habit of Palms. *Principes* 5: 83-89.

———. 1961b. *Anatomy of the Monocotyledons* (ed. C. R. Metcalfe), vol. II, *Palmae*. Oxford.

Nature's Biggest Bouquet

W. H. HODGE

Longwood Gardens, Kennett Square, Pennsylvania

If P. T. Barnum were alive and interested in horticulture and in particular palm culture, he would doubtless try to grow a talipot palm (*Corypha umbraculifera* L.) just to show off the world's biggest bouquet. This would be no exaggeration, for this handsome palm of North Malabar and Ceylon produces a great terminal flower cluster often measuring 20 to 30 feet high and just as broad, bearing countless thousands of tiny creamy white flowers. An inflorescence of such gigantic proportions easily surpasses that of any other flowering plant. It is two to three times larger and far more massive than that of Sumatra's titan arum (*Amorphophallus titanum*), sometimes described incorrectly as the world's biggest "flower."

Unfortunately, few gardeners in the continental United States could ever successfully flower a talipot palm, though I can imagine that some Texans might like to try! Talipots are strictly tropical plants which means that Hawaii is the only state where they can presumably be grown to blossoming age with the possible exception of South Florida. Even there this palm should hardly be considered for average backyard planting. Mature specimens may attain a height of 40 to 80 feet with trunks often reaching 3 feet in diameter. Nor are the leaves puny. Indeed, Barnum might also have boasted of this palm as producing the largest cluster of giant leaves. Few other examples of plant symmetry and architecture are as impressive as the view gotten by looking up a talipot trunk through the massive spiraling leaf stalks. The great leaves with their stout petioles fan out to form giant green umbrellas spreading to as much as 16 feet in diameter. Only the leaves of a few other palms surpass them in size.

Though talipots thrive as ornamentals in the American tropics, to appreciate them to the fullest one should observe them in their native land. Ceylon is such a place where long association with man has made them important not only as ornamentals but as economic plants as well. The talipot is the national floral emblem of Ceylon. This is high esteem for a species which has to compete in affection not only with a wealth of other plants but also with two other highly utilitarian palms, the palmyra

61. The world's largest bunch of flowers, the inflorescence of a talipot palm, towers high above companion coconut and betelnut palms on a Ceylon hillside. Photograph by W. H. Hodge.

62. The appearance of the great flower cluster marks the gradual collapse of the leaves on the stem. Photograph by W. H. Hodge.

palm (*Borassus flabellifer*—a palm with reputedly 800 uses) and the widespread coconut (*Cocos nucifera*), the latter considered by many to be one of the world's ten most important trees. In conferring the honor on the talipot Ceylon appears to be the first nation to officially recognize a palm in this capacity.

63. At maturity thousands of cherry-sized white fruits replace the cream-colored flowers of *Coryphya umbraculifera*. Photograph by W. H. Hodge.

Talipots are picturesque features of the green Singhalese countryside which is one of the most beautiful in the tropics. Though of rather scattered dispersal these great trees make their presence known by simply towering above the groves of coconut and betelnut palms which are widely cultivated. When a

talipot is in flower there is no passing it by. The giant paniculate inflorescence with its multitude of cream-colored flowers (and sour milk scent!) forms a gorgeous sight especially when seen against a blue tropical sky. Unlike most palms, the talipot, century-plant-like, flowers but once in its lifetime and then dies. Its early life is spent in building up food reserves sufficient for this mighty blossoming splurge. Botanists term this habit monocarpy which, freely translated, means "one-time flowering." Talipots in their native country are also gregarious in their flowering; that is, all individual palms originating from the same seed year start flowering at the same time. Thus there appears to be a sort of built-in time clock, innate in each individual talipot which "notifies" the palm of its flowering period no matter where the palm is growing or what differences it may have experienced in environmental conditions. The physiological conditions behind this curious habit are not yet understood by plant scientists. However, cultivated trees in Trinidad though planted at the same time have not all flowered together.

Flowering age is reached after 30 to 40 years of steady vegetative growth. During this period food materials (in the form of starch) needed for the single great reproductive event are stored in large quantities in the soft central part (pith) of the trunk, forming a kind of edible sago which is sometimes used by man for food or as a flour for making sago bread. When so used the tree must be felled and the sago dug out. A forewarning of flowering is given in a mature palm by a gradual decrease in the size of new leaves produced. As food materials become shunted from the storage part of the trunk to the developing inflorescence bud, all leaves begin to wither and eventually collapse against the stem. Several weeks are required for the great flower cluster to expand fully. By the time the flowers have been converted into the hard, white, cherry-sized fruits (approximately a year), most leaves have died, and once fruits have fallen, all leaves finally drop off, leaving nothing but annular leaf scars on a bare bole surmounted by a dried-up fruit cluster. Shortly thereafter, what was but recently one of the most majestic of palms in one of nature's most extraordinary floral displays, is dead.

To the Singhalese the talipot has long been a plant of utility as well as of beauty. Besides the edible sago mentioned above, a usable fiber (the fibrovascular bundles) is also obtained from the trunks whose basal sections are also the sources of native drums. The hard white seeds are reported to be a substitute for ivory in making buttons, beads, etc., while the pounded paste of the fruits is utilized as a fish poison. The Hindustani names *tal* (palm) and *pata* (leaf), combined to yield the corrupted Anglicized word "talipot", hint of the leaf as being the most valuable part of this palm. And so it proves to be. The great leaves serve as a readily available material for thatching and for handicrafting mats, fans and baskets.

Of more interest is the fact that talipot leaves were to the ancient Singhalese what papyrus was to the Egyptians, namely the source of a basic paper for writing. Talipot leaves, however, demanded far less processing than papyrus to serve as a paper. Since the segments of each fanlike leaf are more or less uniform in width, they are readily separated or torn into similar-sized strips called *olas*, which can be cut into any length desired for writing purposes. In practice apparently only immature leaves were used. These were killed and bleached by dipping into boiling water

to insure a legible writing surface when ready for use. Following this a smooth stone or hard piece of wood was rubbed back and forth over each *ola* strip, giving it a smooth polished surface. In more recent years such strips have simply been ironed flat. Steel styli served as the actual writing instruments and once the characters were etched into the leaves, lampblack or a similar blackening medium was rubbed in to better bring out the characters. To produce a book a group of strips needed only to be strung together between covers which were usually made of hardwood decorated and finished with lacquer.

The method used in producing early Singhalese *ola* books of this sort is well described by the English sailor, Robert Knox, in his *Historical Relation of Ceylon* (London, 1681). This fascinating account, accepted as one of the best source books of 17th century Ceylon, is based on Knox's personal experiences during nineteen years of captivity (1660-1679) in the Kingdom of Kandy. An interesting thing is that many of Knox's descriptions, particularly those of plants and agriculture, apply just as much to Ceylon country life today in the 20th century as they did during the years of his enforced sojourn on the island 300 years ago. The talipot palm is described several times, and two interesting illustrations feature the palm or its productions. Under the subject "Learning, Astronomy, and Art Magick", Knox writes:—

> "They write not on Paper, for of that they have little or none; but on a Talli-pot leaf with an Iron Bodkin, which makes an impression. This leaf thus written on, is not folded, but rolled up like Ribbond, and somewhat resembles Parchment.
>
> "If they are to write a Book, they do it after this manner. They take the Tallipot leaf, and cut it into divers pieces of an equal shape and size, some a foot, some eight inches, some a foot and an half long, and about three fingers broad. Then having thus prepared the leaves, they write in them long ways from the left hand to the right, as we do. When the Book is finished they take two pieces of board, which are to serve for the cover of the Book. To these boards are fastened two strings, which do pass thro every leaf of the Book, and these tye it up fast together. As the Reader hath read each leaf, he lifts it up, and lays it by still hanging upon the strings, and so goes to the next leaf, something resembling Bills filed upon Wyre . . .
>
> "They write upon the Tallipot leaves Records or matters of great moment, or that are to be kept and preserved: . . . They make Leet, that is Almanacks that last for a Month. They are written upon a Tallipot leaf, a little above a foot long, and two fingers broad."

Even today in Ceylon one may obtain *ola* leaf strips inscribed in the ancient manner described above. *Ola* books too, recording Buddhist sermons, scriptures, medicinal prescriptions and charms, are also to be seen. Many of these have been handed down from generation to generation. Actually, the practice of *ola* book manufacture still continues in the remoter areas of the island where these primitive books of palm leaf "paper" are used for maintaining records in the absence of printing presses or modern papers. Horoscopes of Singhalese people are said to be always written on talipot *olas*. Most Singhalese women have their horoscopes supplied in this manner. They are essential for the arranged marriage and almost as important as the dowry. Newspaper ac-

64. First illustrations of the talipot palm appeared in Robert Knox's famed journal on Ceylon first published in 1681. 64 and 65 photographed from Knox by W. H. Hodge.

65. Ancient Singhalese umbrella made of a section of a leaf from a talipot palm illustrated by Robert Knox in *Historical Relation of Ceylon*, 1681.

counts in 1960 stated that in selecting the proper date for assuming her office, the present Prime Minister of Ceylon, Mrs. Bandaranaike referred to her horoscope; it may well have been an *ola* book of tal leaves.

66. A polelike stem and dried up fruit cluster is all that remains a year or two after the spectacular flowering of a talipot palm. Photograph by W. H. Hodge.

In a chapter on the fruits and trees of Ceylon, another important use of the talipot is also described and figured by Knox. In this same chapter he gives the first full account of this palm to appear, at least in the English language.

"The Tallipot is as big and tall as a Ships Mast, and very streight, bearing only Leaves; which are of great use and benefit to this People; one single Leaf being so broad and large, that it will cover some fifteen or twenty men, and keep them dry when it rains. The leaf being dryed is very strong, and limber and most wonderfully made for mens Convenience to carry along with them; for tho this leaf be thus broad when it is open, yet it will fold close like a Ladies Fan, and then it is no bigger than a mans arm. It is wonderful light, they cut them into pieces, and carry them in their hands. The whole leaf spread is round almost like a Circle, but being cut in pieces for use are near like unto a Triangle: They lay them upon their heads as they travel with the peaked end foremost, which is convenient to make their way thro the Boughs and Thickets. When the Sun is vehement hot they use them to shade themselves from the heat. Souldiers all carry them; for besides the benefit of keeping them dry in case it rains upon the march, these leaves make their Tents to ly under in the Night. A marvelous Mercy which Almighty God hath bestowed upon this poor and naked People in this Rainy Country! one of these I brought with me into England, and you have it described in the Figure. These Leaves all grow on the top of the Tree after the manner of a Coker [coconut palm]. It bears no kind of fruit until the last year of its life, and then it comes out on the top, and

67. Century-old leaf strips (*olas*) of the talipot palm here containing medicinal prescriptions in Singhalese served as primitive "paper" in old Ceylon. Longwood Gardens photo by G. Hampfler.

spreads abroad in great branches, all full first of yellow blossoms, most lovely and beautiful to behold, but smell very strong, and then it comes to a Fruit round and very hard, as big as our largest Cherries, but good only for seed to set: and tho this Tree bears but once, it makes amends, bearing such great abundance, that one Tree will yield seed enough for a Countrey. If these Trees stand near any houses, the smell of the blossoms so much annoyes them, that they regarding not the seed, forthwith cut them down. This Tree is within a Pith only, which is very good to eat if they cut the Tree down before it runs to seed. They beat it in Mortars to Flower, and bake Cakes of it; which tast much like to white bread. It serves them instead of Corn before their Harvest be ripe."

Like *olas*, talipot-leaf umbrellas are still made and used in modern Ceylon though nowadays they are to be seen almost exclusively in the hands of a certain sect of Buddhist monks, the Ramana Nikaya. Examination of these 20th century talipot-leaf umbrellas indicates that they have evolved some since Knox's time. They are no longer simply a folded talipot leaf, but have been adapted so that the plicate leaf is supported by a mechanism similar to that found in the modern silk umbrella.

In view of the many centuries of asso-

68. Saffron-robed Buddhist monks carry talipot-leaf umbrellas similar to type used for centuries in the Old Kingdom of Kandy. Photograph by W. H. Hodge.

ciation with man during which its leaves —quite aside from their use as a paper —have faithfully served him as a shelter against sun and rain, it seems entirely appropriate that the talipot's Latin name, *Corypha umbraculifera*, supplied by Linnaeus in 1753, means, if literally translated, the palm that bears umbrellas.

THE EDITOR'S CORNER

With three lengthy articles in this issue and the Editor in haste to leave for an autumn collecting and study trip in Mexico, little need be said here save to introduce Dr. Armando Dugand, author of "Palms of Colombia." Dr. Dugand was formerly associated with the Herbario Nacional de Colombia, Universidad Nacional, Bogotá, Colombia, but now lives in Barranquilla. He has for a long time been a student of Colombian palms. Articles by him have appeared in several botanical periodicals including the most useful "Palmas de Colombia" which appeared in *Calda* . 1: 20-84. 1940. Dr. Dugand knows the palms of Colombia intimately and gives us herein a description that makes at least one botanist's feet itch!

Palms of Colombia

ARMANDO DUGAND
Barranquilla, Colombia

Colombia has the second richest palm flora in the world. It is excelled in this respect only by Brazil. Within its land area of 439,400 square miles (about half again as large as Texas) no less than 293 native species pertaining to 56 genera have been recorded so far, mostly vouchered for by botanical specimens deposited in herbaria. Two additional genera are likely to be found in the southern portion of the country. Furthermore, the cultivated (non native) palms number over thirty species of at least twenty genera.

The number of species will be probably diminished somewhat as further taxonomic studies reveal that some of the names proposed are but invalid synonyms. However, the writer feels reasonably certain that the quantity of authentic species yet undiscovered or awaiting description and naming offsets the loss by very far, and in all likelihood will carry the total number of the Colombian species of palms well above 300.

Brazil, almost eight times as large as Colombia, has been credited with 440 species of palms by B. E. Dahlgren in the geographical list of his "Index of American Palms" (*Field Museum of Natural History, Botanical Series* 14: 426-436. 1936). It is quite probable however that the Brazilian palm flora exceeds 550 different kinds.

Of the 201 specific names of palms listed under Colombia in Dahlgren's Index (pp. 414-418) at least the following sixteen either belong to doubtful concepts or to species that probably do not range into this country: *Pholidostachys pulchra; Geonoma andina, G. Barthia, G. leptoclada, G. Margraffia, G. paraguanensis, G. polyneura, G. simplicifrons, G. ventricosa; Catoblastus praemorsus; Chamaedorea flavovirens; Euterpe acuminata, E. Carderi; Bactris acanthospatha, B. setosa; Pyrenoglyphis leucacantha.* On the other hand, of the 440 specific names cited under Brazil in the same Index (pp. 426-436) ten should be included primarily in the Colombia list, as I have shown elsewhere (*Revista de la Academia Colombiana de Ciencias* 5 (18): 212-216. 1942). The reason for this shift is that the types were collected along the Japurá or Caquetá River in a region which was claimed by Brazil at the time of Martius' voyage (*) but now formally belonging to Colombia by treaty. The ten names thus affected are *Lepidocaryum gracile, Geonoma arundinacea, G. laxiflora, G. pycnostachys, Iriartea ventricosa, Iriartella setigera, Chamaedorea pauciflora, Hyospathe elegans, Bactris fissifrons,* and *Desmoncus tenerrimus.*

Since the appearance of Dahlgren's Index in 1936 a great number of palms specimens have been gathered in Colombia mainly by Dr. José Cuatrecasas (Department of Botany, Smithsonian Institution, Washington, D. C.), and Dr. Richard Evans Schultes (Botanical Museum, Harvard University, Cambridge, Mass.). Other interesting but lesser collections have been made by Mr. and Mrs. Mulford B. Foster of Orlando, Florida,

*The type specimens were gathered by the great student of palms Karl Friedrich Phillip von Martius (1794-1868) who travelled extensively on the Amazon River and one of its largest northern tributaries, the Japurá or Caquetá, in 1819-20. The farthest points reached by Martius (January, 1820) are Araracuara and the Messay or Engaños River, 230 miles within Colombian territory.

69. *Phytelephas Seemannii* at Villa Arteaga, Antioquia province, Colombia. Photograph by W. H. Hodge.

Mr. Paul H. Allen, and the writer assisted in part by Mr. Roberto Jaramillo of the Instituto de Ciencias Naturales, National University, Bogotá, Colombia. Scientific papers concerning these collections and other palms of Colombia have been published in recent years by Dr. Liberty Hyde Bailey and Dr. Harold Emery Moore, Jr. (Bailey Hortorium, Ithaca, N. Y.), and the writer. Dr. Max Burret (Botanisches Museum, Berlin, Germany) has contributed in a very great measure to the knowledge of the palms of Colombia by describing the numerous specimens gathered in this country by Friedrich Karl Lehmann and particularly by Wilhelm Kalbreyer in the latter part of last century, and other collectors (Dr. Arnoldo Schultze, Mrs. Edith Dryander, Mr. Jesús M. Duque) in the twenties and thirties of the present century.

Dr. Harold E. Moore, Jr., is studying the species of *Chamaedorea* and *Geonoma* of the Colombian National Herbarium. These two groups comprise many little-understood species, and probably some undescribed ones. The present writer is engaged—when his usual occupations permit—in the preparation of a check-list of the Colombian Palms.

The remarkable wealth of the flora of Colombia obeys largely to the privileged geographical situation of the country at the junction of three important centers of vegetational distribution. These are, (1) the vast Amazonian *hylaea*—the richest palm region in the world—which extends from northern Brazil and Peru through fully one-third of Colombia's territory in its southeastern section; (2) the primitive rain forests of the Pacific-Atrato drainage area covering the extreme western part of Colombia from the border of Ecuador northward along the Pacific coast region to the Darién country, and thence connecting with Central America through the isthmus of Panamá; (3) the mighty Andean mountain system entering southwestern Colombia from Ecuador and soon dividing into three lofty, distinct ranges which traverse the country roughly in southwest to northeast direction.

Colombia, located in the northwestern corner of South America, lies entirely within the tropics—from the Caribbean Sea southward to the Amazon River, and westerly from the Orinoco River to the Pacific Ocean. Were it not for the mountains, the climate would be uniformly hot all over the Colombian territory; but the three great branches of the Andes, separated from each other by large and deep valleys descending to the torrid zone, are the cause of considerable diversity in climatic conditions according to elevation.

One way of picturing the striking distribution of altitudinal climatic zones in Colombia is to imagine a four-storeyed house built in the middle of a large

tropical garden. Let us fancy that, in spite of the tropical setting of the surrounding landscape, the roof of this house is permanently covered with snow, and each of its four floors has a different temperature: The ground floor is definitely tropical, its air is hot, humid and oppressive; but as we climb up the stairs we find that the temperature is mildly warm or sub-tropical in the second floor, temperate and like spring time in the third; while in the fourth, immediately under the snow-covered roof, one enjoys as cool and often as chilly a weather as in late autumn in the northern United States.

In northern latitudes one does not expect to find a roof covered with snow in the heat of midsummer. It seems just as paradoxical to see a snow-capped mountain in the tropics, near the equator. Yet, this is definitely true in many mountainous tropical countries, such as Colombia, where the traveller may easily pass through different climates in a few hours, from the suffocating weather of the seashore and the lower valleys to the snowfields of the upper mountains where the temperature averages all year round a few degrees above or below freezing point.

70. *Manicaria atricha.* The large fronds of *uachi* palm found along the Vaupés River in Amazonian Colombia. The fronds of *Manicaria* are frequently entire, that is, not divided into segments. Photograph by J. Cuatrecasas.

71. *Astrocaryum Chambira.* In eastern Colombia this prickly palm is known as *cumare* and is one of the several species known as *tucum, tucumá* and *chambira* in the region bordering Brazil and Peru along the Upper Amazon and its tributaries. From the leaves the natives make hammocks, hats, sleeping-mats, fish lines, and cordage renowned for its strength. Photograph by J. Cuatrecasas.

It is a well-known fact that the temperature of the atmosphere diminishes with altitude. In the Andes of Colombia the rate of decrease averages 3° Fahrenheit for every 1000 feet elevation. At sea level the mean annual temperature stands in the lower eighties, and therefore at about 16,000 feet the line of perpetual snow is reached. According to

72. *Bactris minor*. The first palm species described from Colombia. The prickly stems form close impenetrable clumps. Known as *lata* on the Caribbean coast of Colombia. Photograph by A. Dugand.

elevation and the varying temperature there is a corresponding variation in the vegetation on the slopes of the mountains. Different belts, each characterized by an assemblage of plants peculiar to it, and sometimes by distinctive types of plant life, correspond to altitudinal zones bounded primarily by isothermal lines of mean annual temperature.

Regarding the palms it seems only too natural to associate these wondrous plants with tropical climate, meaning usually the hot, sultry type of weather found only in the lowlands near the equator; however, on the lofty Andes of Nariño in southwestern Colombia, quite close indeed to the equatorial line, *Ceroxylon utile* has been reported by H. Karsten (*) at a record altitude of 13,450 feet above sea level, not far below the limit of perpetual snow. The mean annual temperature in the high mountain region where this palm grows is about 42° F. while the daily temperature may range from a few degrees below freezing to a maximum of 63° F. Other bold and interesting palms thrive on the Colombian Andes between 8000 and 10,000 (a few to 11,000) feet; they are chiefly *Aiphanes echinocarpa, A. leiospatha; Ceroxylon coarctatum* (to 10,600 ft.), *C. floccosum* (to 11,150 ft.), *C. quindiuense* ("C. andicola" of authors), *C. Vogelianum, C. Schultzei, C. sclerophyllum; Chamaedorea Dryanderae* only to 8,000 ft.; *Euterpe aphanolepis, E. dasystachys, E. frigida, E. oocarpa, E. purpurea, E. zephyria; Geonoma aulacophylla* (to 10,600 ft.), *G. macroclada, G. macroura, G. pachyclada, G. plicata, G. Stuebelii, G. trichostachys* (to 10,600 ft.), *G. uncibracteata* (to 10,600 ft.); *Morenia robusta;* and "*Roebelia solitaria*" (to 10,600 feet).

Below 7,000 feet the number of species as well as of genera increases very rapidly as one descends gradually toward the warm lowlands. In fact, 24 genera are restricted to the lower Tropical Zone *below 2000 feet;* they are: *Ammandra, Astrocaryum, Copernicia, Corozo* (or *Alfonsia*), *Cuatrecasea, Desmoncus, Iriartella, Leopoldinia, Lepidocaryum, Manicaria, Mauritia, Maximiliana, Metasocratea, Orbignya, Parascheelea, Pyrenoglyphis, Raphia, Reinhardtia* (*Malortiea*), *Roystonea, Synechanthus, Taenianthera, Tessmanniodoxa, Yarina,* and *Yuyba.* Among

*H. Karsten, Plantae Columbianae in *Linnaea* 28: 255. 1856 as *Klopstockia utilis.*

them, the following have been found so far only below 500 feet altitude and most of them quite near the level of the sea: *Ammandra, Copernicia, Metasocratea, Orbignya, Raphia, Reinhardtia* and *Synechanthus.*

The richness of the palm flora of this lower megathermic zone of Colombia—which covers as much as three-fourths of the total area of this country—is further emphasized by the presence in it of 26 other genera which *also* grow at higher altitudes. Thus, 50 out of 56 palm genera known in Colombia—or 89%—are found below 2000 feet altitude, and nearly half (43%) of them are apparently particular *only* to this lower zone.

Asterogyne, Cryosophila, Mauritiella, Oenocarpus, Phytelephas, Sabal, and *Socratea* thrive most abundantly below 2000 feet, but they are also found in the neighborhood of 3300 feet, particularly in western Colombia. The only specimen known of the rare genus *Kalbreyera* was collected at 3280 feet. Species of *Acrocomia, Attalea, Bactris, Guilielma, Hyospathe, Iriartea, Jessenia, Scheelea, Syagrus, Welfia,* and *Wettinia*—usually lowland-inhabiting genera—are known to occur on the slopes and valleys of the Andes between 3000 and 6000 feet, whereas *Dictyocaryum, Pholidostachys,* and *Wettiniicarpus* have not been recorded as yet below 3900 feet nor above 6600 feet. In contrast, *Ceroxylon* thrives only on the upper mountain slopes above 5000 (mostly above 7000) feet; the doubtful genus *Roebelia* is known only from the neighborhood of 8000-10,000 feet; and *Morenia* ranges from 1650 to 9200 feet. As far as known *Ceroxylon* is the only palm found at 11,000 feet or above.

Catostigma occurs close to the seashore on the Pacific Coast (*C. Dryanderae, C. radiatum*) and is also found from 5400 to 6600 feet on the Andes (*C. megalocarpum, C. sphaerocarpum*). A very closely related genus, *Catoblastus,* ranges from 1500 feet at the foot of the Eastern Andes (*C. pubescens*) to an elevation of 7500 feet on the same mountain chain (*C. andinus*).

Chamaedorea, the well known genus of small, pretty, shade-loving palms is at home in Colombia either in the steaming jungles of the lower zone (*C. integrifolia, C. lanceolata, C. pauciflora* and many others) or in the temperate "cloud forests" that clothe the Andean slopes at 6000-8000 feet (*C. columbica, C. concinna, C. Dryanderae*).

The widest altitudinal distribution for palms in Colombia pertains to the genera *Euterpe* (19 species) and *Geonoma* (66 species), both of which thrive in many places from the swampy forests of the Pacific seashore (*Euterpe Cuatrecasana, E. rhodoxyla; Geonoma linearis, G. pa-*

73. *Catoblastus* sp. showing characteristic whorled inflorescences still enclosed in the tough leathery spathes. This is one of the "stilt palms" so-called because the stem is supported on a cone-shaped mass of prop roots. Photograph by J. Cuatrecasas.

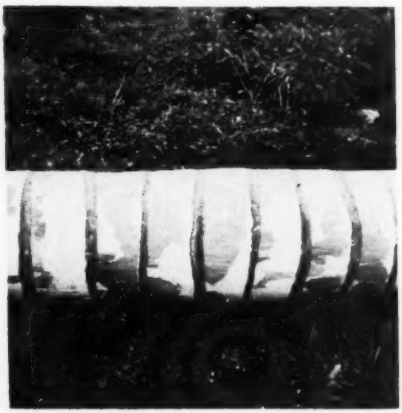
74. *Ceroxylon ferrugineum* on the western slope of the Central Andes in the Quindío region of Colombia, altitude 7,300 feet. Photograph by A. Dugand.

radoxa) to as high as 10,600 feet on often foggy mountain tops where it is chilly most of the time (*Euterpe dasystachys, E. frigida; Geonoma trichostachys, G. uncibracteata*). A close third is the prickly *Aiphanes* (20 species) ranging from about 500 feet (*A. caryotifolia, A. orinocensis*) to the vicinity of 10,500 feet (*A. leiospatha*); most of the species, however, are particular to the intermediate mountain zone between 4000 and 7000 feet.

Attalea, Scheelea, and *Syagrus,* three important "cocoid" genera comprising stately or sometimes acaulescent palms with very large leaves are seldom found above 4800 feet: their main realm are the forests and open woodlands of the lower zone in which they occasionally grow in almost pure stands or share the ground with the lofty *Maximiliana elegans,* the commanding *Jessenia polycarpa* and *J. Bataua,* the graceful *Euterpe precatoria,* and the strange-looking stilt palms *Iriartea Corneto, I. ventricosa, Socratea elegans, S. exorrhiza.* On the Caribbean coastal plain *Scheelea magdalenica* often associates with *Sabal mauritiaeformis.*

Among the prickly palms (see also *Aiphanes* above) the horridly armed species of *Astrocaryum* and the climbing, vine-like, hook-bearing *Desmoncus* are confined to the lowland forests, especially along river banks; the slender-stemmed *Bactris* range from sea level (*B. minor*) to 6000 feet (*B. macrotricha*), and one species of *Acrocomia* (*A. antioquiensis*) reaches the altitude of 5000 feet though it is most commonly found at much lower levels.

Confined to the swampy coastal forests about the mouth of rivers within the influence of tides is the odd monkey-cap or sleeve palm locally known as *jicara* or *jiquera* (*Manicaria saccifera*) whose large, rigid fronds, 30 feet long and 6 feet broad, are frequently simple



75. *Ceroxylon quindiuense.* A felled trunk showing patches of thin whitish film of waxy substance covering the spaces between the ring-like leaf scars. Colombia at an elevation of 7,300 feet. Photograph by J. Cuatrecasas.

or entire, that is, not divided into segments or pinnae. Quite as remarkable is the spathe, a closely woven yet stretchy, soft, brown, pointed fabric or sleeve 2 to 3½ feet long, from which the natives make small sacks and bonnets. Another palm restricted to the same environment is the striking Pángana (*Raphia taedigera*) whose huge leaves, rising almost vertically and then arching gracefully, are among the largest known of any plant, being 40 to 50 feet in length. The handsome fruits are covered with overlapping, mahogany-colored scales.

The first two palms known from Colombia were described and named by the eminent botanist Nicolas Joseph Jacquin in 1763. They are *Bactris minor* and *Bactris major*, the latter being sometimes known today as *Pyrenoglyphis major*. Jacquin visited Cartagena on the Caribbean coast of Colombia—then a celebrated stronghold of the Spanish Main—in 1758 and discovered both palms in the vicinity of the town. *Bactris minor* grows about marshes or in periodically inundated ground, and has a subterranean stock from which many slender stems, about 2 inches wide, rise to a height of 10-15 feet, being covered with a profusion of vicious prickles which readily enter the skin.

The fruits are small, purple-black when ripe, and clustered like grapes. A sourish, flavorous and refreshing beverage, wine-red in color and locally known as *chicha de corozo* is made by mashing the fleshy part of the fruits, adding water and sugar, and chilling. *Pyrenoglyphis major* is a somewhat larger palm; its stems reach 20-25 feet in height. It is found on shady banks along streams. Both this and *Bactris minor* are exceedingly prickly palms and they form close, forbidding clumps. Their stems, known locally as *lata*, are widely used in rural areas or northern

76. *Ceroxylon* sp. This is the lone remnant of a once dense population of lofty wax palms overtopping the tallest trees before the forest was cleared. The trunk of this individual is just short of 150 feet tall. A man is scarcely visible at the base of the trunk. Western slope of the Eastern Andes, 8,400 feet. Photograph by R. Jaramillo.

Colombia for building huts and rustic houses. The same use is given in other parts of the country to the stems of many species. Palm trunks split and flattened into boards are often used for flooring houses. Material for thatching is obtained from a great many different species. Among the most durable—over thirty years—are the fan-shaped leaves of the *sará* or *palmiche* (*Copernicia tectorum*) and *palma amarga* or *chingalé* (*Sabal mauritiaeformis*) which grow in the Caribbean coast region.

Modernity is very rapidly substituting its own building materials throughout the civilized part of Colombia, except in some backwoods. Yet in the vast regions which are inhabited by primitive Indians

77. *Dictyocaryum globiferum*, one of the tallest palms in Colombia. The slender trunks reach 120 feet in length. The almost perfectly spherical kernels look like marbles. Known only from the mountains above Florencia, Caquetá, 4,300 feet. Photograph by A. Dugand.

the palms are still of primary importance to the natives for they furnish not only materials for shelter, but food, fibers, timber, weapons, and many minor products.

Excellent hammocks and fairly good cloth, coarse hats, fishing lines, nets and other cordage are made by the Indians from the young leaves of the *cumare* (*Astrocaryum Chambira*) and the *moriche* or *canangucha* (*Mauritia minor*). Both palms are widely spread in the vast plains of the Amazon and Orinoco basins in southeastern Colombia. Indians in the Vaupés region near the Brazilian border use the slender stems of *Iriartella setigera* and particularly *Cuatrecasea Spruceana* for making their blowing canes or blowguns. The darts are readily made from the stout, straight, spine-like veins which persist as remnants of the leaf-sheaths encasing the trunk of the *patauá* (*Jessenia Bataua*). The tough yet flexible, blackish brown, fibrous wood of *Guilielma Gasipaes*, generally known as *chonta*, *chontaduro* or *macana*, is used by Indians for the manufacture of bows, arrow points, spears, daggers, blowgun darts and fishing hooks.

The young leaves of the *estera* (*Astrocaryum Malybo*), bleached in the sun and fancifully colored with vegetable or other dyes are woven with fibers of *bromeliads* into a sort of sleeping-mats called *estera* which are much in demand in the rural districts of northern Colombia.

The well known Pará piassaba fiber, used for brooms and brushes and also for ropes, hats and baskets, is the product of the *chiquichique* (*Leopoldinia Piassaba*). This palm grows mostly in low sandy flats, sometimes subject to overflow, but not in swampy lands, along the "black water" rivers of the Amazon-Orinoco drainage in the border region of Colombia, Venezuela and Brazil. The long, tough yet flexible, brown fibers are produced abundantly on the margins of the old, frayed leafstalks which hang down covering the trunk to the very base in a dense, beard-like mass.

The fruits of some palms, when triturated with boiling water, and after separating (or not) any oil which they may yield, afford a creamy "wine" or "milk" relished by the natives and having a pleasant flavor. The best known are the *chicha de corozo* mentioned above, made from the fruits of *Bactris minor;* and the *leche de seje* or *leche de milpeso* produced by *Jessenia polycarpa*, which is probably not different from the *patauá* palm (*Jessenia Bataua*) of the Amazon. A similar beverage is also made from the fruits of the *chiquichique* (*Leopoldinia Piassaba*), the *moriche* or *canangucha* (*Mauritia minor*) the *bacaba* (*Oenocarpus Bacaba*), and the *bacabiña* or *milpesillo* (*Oenocarpus minor*). The "wine" of the *moriche* (*Mauritia*) is usually allowed to ferment before using.

The fatty fruits of the peach palm (*Guilielma Gasipaes*), variously called *pijibay, cachipay, chontaduro, pipire, pijiguao, pirijao,* or *pupuña* depending upon the region, are very nutritive and savory when boiled to tenderness in salted water, and they constitute such an important item of food among the Indians that the palm is cultivated by them and appears quite commonly around their settlements.

Edible kernels having the nutty flavor of semi-dry coconut meat are produced by species of *Attalea* (*A. amygdalina, A. nucifera, A. septuagenata, A. uberrima, A. victoriana*), *Orbignya* (*O. Cuatrecasana*), *Parascheelea* (*P. anchistropetala*), and *Scheelea* (*S. butyracea, S. magdalenica*), all of which yield fine, edible oil but are usually not exploited commercially in a large scale for want of truly efficient machines capable of breaking the thick, very hard shell of the nuts without damaging the kernels. A fine oil extracted from the crushed and boiled ripe fruits of the *milpeso* or *seje* (*Jessenia polycarpa*) has found limited use in the treatment of certain lung ailments. Peasant women in northern Colombia use a blackish, fatty substance extracted from the fruit of the *noli* (*Corozo oleifera*) to dress their hair. It is supposed to combat dandruff and to prevent the hair from falling or turning gray. This species is related to the African oil palm (*Elaeis guineensis*).

The chief source of the "vegetable ivory" of commerce are the Colombian *tagua* palms (*Phytelephas*). These are characteristic palms of river banks, having stout trunks which are either creeping, to 20 in length though rising not more than 6 feet from the ground (*P. Seemannii*), or upright and attaining a height of 20 feet (*P. tumacana*); in another species (*P. Karstenii*) the trunk is very short or wanting. The fruit is large, globose, spiny, with a hard woody shell in which are contained four to nine seeds or "nuts". *Tagua* nuts, white and hard as true ivory, can be carved and turned beautifully and are used in the manufacture of buttons, inlays, and various small ornamental articles.

78. *Guilielma Gasipaes* var. *mitis*, an unarmed variety of the otherwise prickly peach palm growing near Puerto Ospina, Putumayo, 1,000 feet. Photograph by J. Cuatrecasas.

Palms of two additional genera (*Palandra aequatorialis* and *Yarina microcarpa*), both belonging to the ivory-palm or phytelephantoid group, have also been reported from Colombia. They are probably to be found in the southern portion of this country. In fact, a photograph of a palm taken by Dr. J. Cuatrecasas in the dank forest of the Putumayo region in southern Colombia near the Peruvian border, in all appearance represents *Yarina microcarpa* and is known to the natives by the same name of *Yarina* used by the Peruvians. As regards *Palandra aequatorialis*, the largest of

the ivory-palms, with a tall trunk and grouped leaf-segments that give it a distinct habit, it is supposed to grow on the Pacific coast near the border of Ecuador. It was originally described from the latter country.

INDEX TO VOLUME 5

Figures in *Italic* indicate pages with photographs or other illustations

Acanthophoenix crinita 101
Acanthorrhiza
  aculeata 101
  Warscewiczii 101
Acoelorraphe Wrightii 70
Acrocomia aculeata 66, 139
  antioquensis 140
  armentalis *63*, 66
  media 107
  mexicana 97
  pilosa 66
  sclerocarpa 59, 101
  subinermis 66
Actinophloeus Macarthurii 81
Aiphanes 59
  caryotaefolia 20
  echinocarpa 138
  leiospatha 138, 140
  orinocensis 140
Alain, Brother 42
  Palms of Cuba 59
Alfonsia 138
Ammandra 138, 139
Archontophoenix 17, 109
  Alexandrae 20, 30, 81, 82, 101, 110
  Cunninghamiana 20, 30, 81, 82, 83, 101, 103, *104*, 107, *108*
Areca Catechu, 8, 58, 59
  concinna 58
  glandiformis 101
  triandra 20, 101
Arecastrum 29, 30, 109, 110
  Romanzoffianum 8, 20, 22, 25, *29*, 30, 81, 101, 103, 107
    var. australe 30
    var. botryophorum 30
Arenga 25, 59, 81
  Engleri 20, 30, 79, 101, 103, *104*, 108
  pinnata 102, 107
  porphyrocarpa 102
Arikuryroba schizophylla 23, *56*, 81
Asterogyne 139
Astrocaryum 111, 138, 140
  aculeatissimum 101
  aculeatum 101
  Ayri 101
  Chambira *137*, 142
  Malybo 142
  mexicanum 101
Attalea 21, 25, 59, 140
  amygdalina 143
  Cohune 101
  macrocarpa 101
  nucifera 143
  septuagenata 143
  spectabilis 101
  uberrima 143
  victoriana 143
Bactris 139
  acanthospatha 135
  cubensis *67*, 70
  fissifrons 135
  Gasipaes 24, 106
  macrotricha 140
  major 101, 141
  minor *138*, 140, 141, 142
  setosa 135
Bacularia 109
Balaka Seemannii 20
Barry, David Jr. 6, 76
  Palms for Home and Greenhouse 13
  Notes on the Hardiness of Palms on the French Riviera 100
Basselinia gracilis 101
Beeler, Bruce H.
  What's In a Name? 36, 111
Bismarckia nobilis 35
Borassus aethiopum 8
  flabellifer 8, 53, 54, 55, 101, 125
Brahea Berlandieri 103
  calcarea 101, 106
  dulcis 30, 36, 101, 106
Butia 30, 101
  capitata 20, 25, *28*, 30, 81, 103, 108
    var. odorata 108
  eriospatha 30, 103
  Yatay 28, 30
Calamus 8, 50, 58, 59, 101
  ciliaris 20
  delicatulus 58
  digitatus 58
  ovoideus 58
  pachystemonus 58
  radiatus 58
  rivalis 58
  scipionum *55*
  Thwaitesii 58
  zeylanicus 58
Calyptrogyne Clementis 69
  dulcis 69
  Ghiesbreghtiana 101
  microcarpa *69*
Calyptronoma 69
Caryota mitis 20, 30, 81
  ochlandra 81, 101
  "plumosa" 20
  Rumphiana 30, 101
  urens 20, 30, 58, 101, 107
Catoblastus andinus 139
  praemorsus 45, 135, *139*
  pubescens 139
Catostigma Dryanderae 139

megalocarpum 139
radiatum 139
sphaerocarpum 139
Caulfield, N. W.
Palms of the Brisbane Botanic Gardens Australia 107
Ceroxylon alpinum 12, 101, 139, 140
andicola 12, 101, 138
coarctatum 138
ferrugineum 140
floccosum 138
quindiuense 138, 140
Schultzei 138
sclerophyllum 138
utile 138
Vogelianum 138
Chamaedorea 97, 101, *104*
Biolleyi 106
cataractarum 17, *19* 20, 81, 103
columbica 139
concinna 139
concolor 20
corallina 106
costaricana 17, *19*, 20, 81, 103
Dryanderae 138, 139
elatior *23*, *106*
elegans *15*, 16, 20, 30, 81, 106
Ernesti-Augusti 17, *19*, 20, 30, 103
erumpens 17, 20, 81
flavovirens 135
fragrans 35
geonomaeformis 20
glaucifolia 81
graminifolia 106
humilis 81
integrifolia 139
Klotzschiana 17, *19*, 20, 106
lanceolata 139
Martiana 106
microspadix 81
oblongata 81, 103, 106
pauciflora 135, 139
radicalis 30, 81
Sartorii 30, 106
Schippii 81
Seifrizii 17, 20, 30
"spiralis" 81
stolonifera 30
Tepejilote 20, 30, 81, 106
Chamaerops 33, 101, 110
humilis 8, 20, 30, 34, 81, 86, 103
var. macrocarpa 103
Chelyocarpus 8
Chrysalidocarpus 111
lutescens 16, 20, *22*, 23, 30, 81, 82, 101, 107, 108
Clinostigma Mooreanum 101
Coccothrinax 44, 45, 66
Alexandrii 67
argentata 20
crinita 44, 67
Dussiana 81
fragrans 67
Miraguama 67, 101
var. orientalis *64*
pseudorigida *64*
Coconut in Hawaii 110
Cocos nucifera 8, 20, 30, 58, 126
plumosa 83
Colpothrinax Wrightii *62*, *63*, 65
Copernicia 138, 139
alba 101
australis 101
Baileyana 68
cerifera 40, 59
Curtissii 68
gigas *65*, 68
glabrescens *21*, 24, *66*
Miraguama 101
rigida 68
tectorum 101, 141
Torreana 47, *61*, 67
vespertilionum *65*, 67
Yarey 68
Corozo 138
oleifera 143
Corypha elata 101
umbraculifera 53, 54, 55, 101, 107, 109, 125, 126, 127, 130, 131, 132, 133, 134
Cryosophila 139
nana 97, 101
Warscewiczii 101, 107
Cuatrecasea 138
Spruceana 142
Cyphokentia gracilis 101
Cyrtostachys Renda 59, 101
Daemonorops 102
Desmoncus 138, 140
tenerrimus 135
Dictyocaryum 139
globiferum 142
Dictyosperma album 20, 30, 108
var. rubrum 81
Didymosperma porphyrocarpum 102
Diplothemium caudescens 102
Drymophloeus Beguinii 20
Dugand, Armando 134
Palms of Colombia 135
Dypsis pinnatifrons 102
Editor's Corner, The 6, 42, 81, 134
Elaeis guineensis 8, 59, 102, *106*, 107, 108, 143
Eremospatha Hookeri 102
Erythea 36
aculeata 99, 110
armata 30, 34, 81, 93, 100, 102, 103, *105*
Brandegeei 30, 96, 102, 106
edulis 30, 81, 102, 103
elegans 102, 110
Eugeissona triste 102
Euterpe acuminata 135
aphanolepis 138
Carderi 135
Cuatrecasana 139
dasystachys 138, 140
edulis 44, 45, 102
frigida 138, 140
globosa 69, *70*
oocarpa 138
precatoria 140
purpurea 138

rhodoxyla 139
zephyria 138
Foster Botanical Garden, Palms of 90
Gaussia princeps *69*
Geonoma andina 135
arundinacea 135
aulacophylla 138
Barthia 135
binervia 24
gracilis 102
laxiflora 135
leptoclada 135
linearis 139
macroclada 138
macroura 138
Margraffia 135
pachyclada 138
paradoxa 139
paraguanensis 135
plicata 138
polyneura 135
pycnostachys 135
simplicifrons 135
Steubelii 138
trichostachys 138, 140
uncibracteata 138, 140
ventricosa 135
Germination of seeds 31
Gregory, Luis E.
Palms of the Federal Experiment Station, Mayaguez, 106
Guilielma 139
Gasipaes 106, 142, 143
Hedyscepe Canterburyana 20, 30
Hemithrinax compacta 70
Ekmaniana 70
rivularis 70
savannarum 70
Hertrich, William
Huntington Botanical Gardens 27
Heterospathe elata 20
Hodge, Walter H.
Palm Handbook Published 4
Linospadix monostachya 89
Nature's Biggest Bouquet 125
Howeia Belmoreana 20, 30, 102, 106
Forsteriana 14, 20, 30, 81, 102
Huntington Botanical Gardens 27
Hyospathe elegans 135, 139
Hydriastele Wendlandiana 102
Hyophorbe amaricaulis 102
indica 102
Verschaffeltii 102
Hyphaene 24, 33
thebaica 53, 59
In and Out of the Palm Garden 42
Iriartea 139
Corneto 140
ventricosa 135, 140
Iriartella 8, 138
setigera 135, 142
Jayaweera, D. M. A. 42
Palms in the Royal Botanic Gardens, Peradeniya, Ceylon 53
Jessenia Bataua 139, 140, 142
polycarpa 140, 142, 143
Johannesteijsmannia altifrons 116
Juania australis 102
Jubaea chilensis 8, *28*, *30*, 102, 106, 109
spectabilis 8, 102
Jubaeopsis caffra 30
Kalbreyera 139
Latania 24, 59
borbonica 81, 102
Commersonii 81, 102
Loddigesii 102, 108
Verschaffeltii 102
Ledin, R. Bruce
Honored Posthumously 80
Leopoldinia 138
Piassaba 142
Lepidocaryum 138
gracile 135
Lepidorrhachis mooreana 101
Letters 75, 109
Licuala 17, *18*, 33, 34, 59
grandis 20
horrida 102
Muelleri 109
spinosa 20, 102
Linospadix monostachya 77, 78, 89, *90*, 109
Livistona 24, 29, 33, 34, 59, 109
australis *28*, 30, 102, 103, 107, 108
chinensis 17, 20, 30, 33, 34, 79, 81, 102, 103, 109, 110
cochinchinensis 102
decipiens *28*, 30, 34, 106
Jenkinsiana 102
Mariae 30, 102
Robinsoniana 33
rotundifolia 17, 20, 26, 33, 34, 102
Woodfordii 33, 34
Lodoicea callipyge 8
maldivica 8, 53, 54, 55
Loxococcus rupicola 58
Macbride, J. Francis
Palmae in Flora of Peru (review) 7
Malortiea 138
Manicaria 138
Atricha 137
saccifera 140
Marnier-Lapostolle, J.
Palms at Jardin Botanique "Les Cedres" 103
Mascarena lagenicaulis 25, 30, 102
Verschaffeltii 30, 79, 81, 102
Mauritia 138, 142
armata 102
flexuosa 102
minor 142
Mauritiella 50, 139
Maximiliana 8, 138
elegans 140
Metasocratea 138, 139
Metroxylon laeve 102
Rumphii 59
Sagu 8, *55*, 59
Moore, Jr., Harold E.
Ceroxylon alpinum the Correct Name for the Quindío Wax Palm 12

Johannesteijsmannia—A New Name for the Palm Genus Teysmannia 116
Morenia 139
robusta 138
Nannorrhops 33
Ritchieana 102
Neanthe bella 16
Nelson, Robert 41
On the Trail of the Lonesome Palms 92
Nenga pumila 102
Wendlandiana 102
Neodypsis Decaryi 39, 40, 71, *73*, *74*
Nephrosperma Vanhoutteanum 102
News of the Society 3, 39, 79, 115
Normanbya Muelleri 102
Normanbyi 102
Notes on Culture 81
Nypa fruticans 8, 24, 58, 59
Oenocarpus 139
Bacaba 102, 142
minor 142
Oncocalamus 88
Oncosperma 85, 102
fasciculatum 58
Opsiandra 85
Orania philippinensis 102
Orbignya 21, 25, 138, 139
Cohune 8, 56, 59, 101, 106
Cuatrecasana 143
Guacuyule 97
spectabilis 101
Palandra aequatorialis 143
Palm Handbook 4
Literature 7
Society News of 3, 39, 79, 115
Palms
For Home and Greenhouse 13
In Decorative Arrangements 20
Morphology of 8, 46, 83, 117
Of Botanical Gardens, 27, 53, 90, 103, 106, 107
Of Cuba 59
Of Colombia 135
Of Peru (review) 7
Parascheelea 138
anchistropetala 143
Paurotis Wrightii 20, 30, *70*, 81
Phloga nodifera 102
Phoenicophorium 110
Borsigianum 102
Phoenix 29, 59, 102, 108, 109
acaulis 86
canariensis 8, 16, 20, *29*, 30, 35, 45, 85, 102, 103, *105*
dactylifera 8, 30, 93, *94*, 96, *99*, 102, 103, 106
humilis 30
paludosa 30, 106
reclinata 20, *23*, 25, 30, 81, 85, 109
Roebelenii 16, *18*, 20, 30, 81, 106, 109, 110
rupicola 20, 30, 106, 109
sylvestris 30, 109
zeylanica 30, 58, 59
Pholidostachys 139
pulchra 135
Phytelephas 139
Karstenii 143
macrocarpa 59, 102
Poeppigiana 102
Seemannii 136, 143
tumacana 143
Pinanga Kuhlii 20, 102
Polyandrocos caudescens 101
Pritchardia 90
arecina *91*
Gaudichaudii 30, 102
Hillebrandii *91*
macrocarpa *91*
pacifica 8, 81
remota *91*
Thurstonii 81
Pseudophoenix 24
Sargentii 70, 102
Ptychosperma 17, 59
elegans 20, 24, 30, 102
Macarthurii 17, 20, 24, 81, 82, *108*, 109
Pyrenoglyphis 138
leucacantha 135
major 141
Raphia 139
pedunculata *55*, 107
Ruffia 20, *22*, 24, 102
taedigera 102, 141
vinifera 8
Ravenea Hildebrandtii 102
Read, Robert W.
Madagascar's Three-sided Palm—Neodypsis Decaryi 71
Reinhardtia 17, 138, 139
gracilis 20
var. rostrata *18*
Rhapidophyllum hystrix 30, 102, 103
Rhapis 17, *23*, 49, 110
excelsa 16, *18*, 20, 30, 81, 102 *106*, 109
flabelliformis 102
humilis 16, 20, 30, 102, 106
Rhopalostylis Baueri 30, 102, -106, 115
sapida 30, 81, 102, 106, 115
Roebelia solitaria 138, 139
Roystonea 102, 138
borinquena *106*, 107
elata 79
lenis 64
oleracea 8, 53, 54, 109
regia 8, 30, *54*, *60*, 109
stellata 64
violacea 64
Sabal 59, 64, 108, 139
Blackburniana 106
causiarum 30, 106, 107
Etonia 86, 103
florida *62*, 65
Japa 65
mauritiaeformis 30, 140, 141
mayarum 65
mexicana 31
minor 31, 75, 86, 103
Palmetto 8, 31, 103
parviflora 65
Rosei 81, 97, 99
texana 31, 103, *106*

umbraculifera 31
uresana 97, 98, 99, 100, 109
viatoris 31
Yapa 31
Saguerus saccharifera 102
Scheelea 21, 25, 139, 140
butyracea 143
magdalenica 140, 143
regia 102
zonensis 107
Serenoa 112
arborescens 102
repens 102, 106
serrulata 102
Socratea 8, 139
elegans 140
exorrhiza 140
Stevensonia grandiflora 102
Syagrus 139, 140
insignis 30, 103
macrocarpa 30
Weddelliana 16, 20, 30, 103
Synechanthus 138, 139
Taenianthera 138
Tessmanniodoxa 8, 138
Tessmanniophoenix 8
Teysmannia altifrons 116
Thrinax 59, 103
Drudei 68
microcarpa 26, 68
parviflora 20, 24, *68*
Wendlandiana 68
Tomlinson, P. B. 6
Essays on the Morphology of Palms
III. Seedling Leaves and Juvenile Foliage 8
IV. The Leaf 46
V. The Habit of Palms 83
VI. The Palm Stem 117
The Problem of Wissmannia 33
Trachycarpus excelsa 103
Fortunei 20, 31, 81, 103
Martianus 31, 103, 106
Takil 31
Wagnerianus 31
Trithrinax acanthocoma 31, 81, 106
brasiliensis 103
campestris 31, 103
Veitchia Merrillii 20, 24, 81
Montgomeryana 24
Wait, Lucita H.
Palms in Decorative Arrangements 20
Wallichia caryotoides 25, 30, 103
densiflora 106
disticha 106
Washingtonia 29, 36, 109
filifera 8, 31, 43, 93, 103
robusta 20, 31, 81, 93, *95*, 96, 103, *105*
Weber, Claude and S. C. Tucker
Flowers and Botanical Subjects on Stam (review) 8
Weissich, Paul R.
Foster Botanical Garden 90
Welfia 139
Wettinia 139
Wettiniicarpus 139
What's In a Name? 36, 111
Wissmannia carinensis, anatomy 33
Yarina 139
microcarpa 143
Yashiroda, Kan
Notes from Yashiroda Junkaen 34
Yocum, Harrison G. 6
A Method for Germinating Palm Seeds 31
Young, Dale
Notes on Culture 81
Yuyba 139

Classified Section

RATES: 5c per word, payable when the ad is submitted. Please send in your copy and payment six weeks ahead of publication date to THE PALM SOCIETY, 7229 S.W. 54th Ave., Miami 43, Fla.

CHAMAEDOREA RADICALIS
Seeds: 10 for 50c, 50 for $2.00
Seedlings: up to 12 inches, 35c each, in sphagnum.
Gallon cans: $2.50 each.
Margaret Dalkranian, 2499 S.W. 15th St., Miami 45, Fla.

SABAL GLAUSCESCENS
Ten-year-old specimens, leaves to 6 ft. across. No trunk as yet. In the ground; dig it yourself, reasonable. Mrs. Arthur Taft, MO 7-1710, Miami, Fla.

NANNORHOPS RITCHIEANA. Fresh seed, $15.00 per 100. R. E. Weaver, 1333 Rigsby, San Antonio 10, Texas.

CYCAD SEED
(Postpaid in U. S. A.).

Cycas revoluta	$3.00 per C
	$25.00 per M
Zamia floridana	$2.25 per C
	$16.00 per M

FLORIDA NURSERY & LANDSCAPE CO., P. O. Drawer 281, Leesburg, Fla.